REMARKS

Claims 27, 49 and 50 have been canceled without prejudice. Claim 19 has been amended. Specifically, claim 19 has been amended to correct a previous clerical error noted by the Examiner (July 2nd Office Action, page 2, lines 6-16). The present amendment addresses the clerical error and has no limiting effect on the scope of the claim 19.

Applicants believe that the present amendment adds no new matter to the application. In view of the present amendment, and for the following reasons, Applicants respectfully request that the present application be reconsidered and the claims allowed.

The Drawings

The Examiner objected to the drawings on the grounds that the subject matter of claims 49 and 50 is not illustrated (Office Action, dated July 2, 2004, also referred to as the "July 2nd Office Action," page 3, lines 4-7). Claims 49 and 50 have been canceled without prejudice. In view of the present amendment, the Examiner's objection to the drawings is moot.

"Peel Strength" as used in the specification and claims is clearly defined in the specification

An applicant may act as his own lexicographer and ascribe a certain meaning to a claim term when the applicant's written description supports that meaning. Digital Biometrics Inc. v. Identix Inc., 1418, 1424 (Fed. Cir. 1998). In the present case, Applicants have specifically, clearly, and with definiteness, defined the meaning of "peel strength" as described by Figure 2 and page 33, lines 1-16, of the present application. Explicitly, Applicants have exercised their right to be there own lexicographers and have ascribed a

certain meaning to "peel strength," and this meaning is supported by the Applicant's written description by Figure 2 and page 33, lines 1-16.

In support of the Applicants position, the following evidence is submitted for the Examiner's review: (i) a copy of Japanese Document JP 06-136300 with English Abstract, and (ii) a Declaration under 37 C.F.R. § 1.132 by Takashi Masuko, executed October 26, 2004 (hereafter, referred to as the "Third Masuko Declaration").

Japanese Document JP 06-136300, submitted in the Information Disclosure Statement filed November 2, 2004, teaches a "conductive paste composition" (See English Abstract) that has a certain die-bonding strength measured in units of "kgf/mm^2" as shown in Table 2. This reference is directed to a conductive paste having a composition similar to the present invention. However, the paste taught by Japanese Document JP 06-136300 is distinguished from the film of the present invention in that paste technology is very different from film technology, although pastes and films can both be used as die-bonding materials.

Japanese Document JP 06-136300 unequivocally establishes that units of "mass-force to area (kgf/mm^2)" is a known and accepted unit for measuring die-bonding strength in the art of making die-bonding materials. In view of this evidence, the Examiner's contention that measuring die-bonding strength using units of mass-force to area would be repugnant to the art, incorrect and/or indefinite (July 2nd Office Action, page 4, lines 17-20, and page 5, lines 9-13) is wholly without merit.

The Third Masuko Declaration is submitted to show the superiority of the peel strength and reflow cracking characteristics of a die-bonding film made in accordance with the present invention over a die-bonding film made in accordance with Embodiment No. 13 of U.S. Patent 5,406,124 (hereafter, the Morita reference), and to proffer testimony by one of the joint inventors regarding the 17-degree peel strength defined by the specification and

drawings of the instant application. In particular, the Third Masuko Declaration (page 7, line 12, to page 10, line 7, and page 10, lines 18-22) provides testimony evidence showing that a person skilled in the art would recognize that the comparative test described on page 33, lines 1-16, of the specification, and shown in Figure 2, of the application as originally filed is a 17-degree peel strength test.

The Invention

The present invention according to claim 17 pertains broadly to a filmy material for a semiconductor device having a support member such as a lead frame to which a semiconductor die or chip is attached using the die-bonding material and then would be encapsulated with resin. More particularly, one preferred embodiment in accordance with the present invention is an organic die bonding film having a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher (as specifically described and defined in the present application) when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2, wherein said film comprises an organic material selected from the group consisting of epoxy resin, silicon resin, acrylic resin and polyimide resin. Other preferred embodiments of the invention are limited to an organic material comprising epoxy resin and polyimide resin.

A second embodiment in accordance with the present invention is an organic die-bonding single layer film having the property of bonding a semiconductor chip to a support member under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2, and having a modulus of elasticity of 10 MPa or less at a temperature of 250°C, wherein the film comprises an organic material selected from the group consisting of epoxy resin, silicon resin, acrylic resin and polyimide resin.

A third embodiment in accordance with the present invention is an organic die-bonding film having the property of bonding a semiconductor chip to a support member under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2, wherein the film has a water absorption of 1.5% by volume or less, a saturation moisture absorption of 1.0% by volume or less, a modulus of elasticity of 10 MPa or less at a temperature of 250°C, a void volume of 10% or less in terms of voids present in the film and at an interface between said film and a support member at a stage where a semiconductor has been bonded to a support member by said film, a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher (as defined in the instant specification) at a stage where a semiconductor has been bonded to a support member with said film, and a residual volatile component in an amount of not more than 3.0% by weight, wherein the film comprises an organic material that includes epoxy resin and polyimide resin.

A fourth embodiment in accordance with the present invention is an organic die bonding film having a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher (as specifically described and defined in the present application) when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2, wherein said film comprises an organic material that includes epoxy resin and polyimide resin.

A fifth embodiment in accordance with the present invention is an organic die-bonding single layer film having the property of bonding a semiconductor chip to a support member under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2, and having a modulus of elasticity of 10 MPa or less at a temperature of 250°C, wherein the film comprises an organic material that includes epoxy resin and polyimide resin.

A sixth embodiment in accordance with the present invention is an organic die-bonding film having the property of bonding a semiconductor chip to a support member under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2, wherein the film has a water absorption of 1.5% by volume or less, a saturation moisture absorption of 1.0% by volume or less, a modulus of elasticity of 10 MPa or less at a temperature of 250°C, a void volume of 10% or less in terms of voids present in the film and at an interface between said film and a support member at a stage where a semiconductor has been bonded to a support member by said film, bonds with a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher at a stage where a semiconductor has been bonded to a support member with said film, and a residual volatile component in an amount of not more than 3.0% by weight, wherein the film comprises an organic material that includes epoxy resin and polyimide resin.

All of the remaining dependent claims recite various other preferred embodiments. The advantages of the preferred embodiments of the film material in accordance with the present invention is that the film material allows for the manufacture of semiconductor devices that have fewer flow cracks and other defects that devices made with silver paste have because the material of the present invention is less prone to forming reflow cracks during the fabrication of semiconductor devices. Thus, devices made with the film material in accordance with the present invention can be reliably manufactured to have good durability that is an improvement over the prior art devices.

The Rejections

Claims 17-19, 21-34 and 37-64 stand rejected under 35 U.S.C. § 112, first paragraph, for lacking enablement. Claims 17-19, 21-34, 37-57 and 64 also stand rejected under 35 U.S.C. § 112, second paragraph, as indefinite.

Claims 17-19, 21-34, 37, 38 and 45-50 stand rejected under 35 U.S.C. § 102(a) as anticipated by Morita (U.S. Patent 5,406,124), or, in the alternative, under 35 U.S.C. § 103(a) as unpatentable over Morita (U.S. Patent 5,406,124).

Claims 18, 26-30, 32, 34, 38, 46, 48, 50 and 64 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Morita in view of Hozoji (Japanese Document JP 05-218107). Claims 44 and 57 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Morita in view of Yoshida (U.S. Patent 5,115,089). Claims 31, 40, 42, 53, 55, 60 and 62 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Morita in view of Berger (U.S. Patent 4,681,928). Claims 43, 56 and 63 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Morita and Berger, and further in view of Yoshida (U.S. Patent 5,115,089). Claims 39, 52 and 59 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Morita and Berger, and further in view of Jackson (U.S. Patent 4,965,331). Claims 41, 54 and 61 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the combination of Morita and Berger, and further in view of Baumann (U.S. Patent 5,296,567).

Applicants traverse the rejection and request reconsideration of the application for the following reasons.

Applicants' Arguments

In view of the present amendment, claim 19 is now in compliance with 35 U.S.C. § 112.

Rejections under 35 U.S.C. § 112, first paragraph, enablement

The Examiner has previously stated for the record the following: "the specification, while being enabling for the species of disclosed Examples 1-7..." (Office Action dated December 31, 2002, page 4, lines 13-14, emphasis added), and Applicants argued that the subject matter of claims 39-44 corresponds to these species (Amendment (C) filed June 30, 2003, page 12, lines 10-12). Applicants assert that claims 52-57 and 59-63 also correspond to the species of Examples 1-7 of the present application.

Alleged Lack of Enablement by Disclaimer

The Examiner presently contends that claims 17-19, 21-34 and 37-64 fail to properly enable a person of ordinary skill in the art, under 35 U.S.C. § 112, first paragraph, to make and use the claimed invention because 'applicant discloses as critical or essential to the practice of the invention the temperature range "100-230°C"' (July 2nd Office Action, p. 4, lines 4-9). Applicants respectfully disagree with the Examiner's inferences and conclusions drawn from Applicants' previous statements for the following reasons.

First, the proper test for enablement is whether the specification teaches enough to those of ordinary skill in the art so they can make and use the invention without undue experimentation. Amgen Inc. v. Hoechst Marion Roussel, Inc., 65 U.S.P.Q.2d 1385, 1400 (Fed. Cir. 2003). Applicants contend the instant application is enabling for die bonding in the range of 100°C to 350°C as supported on page 17, lines 13-23, of the present specification, with a preferred range of 100°C to 250°C described on page 4, lines 21-23. Furthermore, an enabling embodiment with die-bonding at a temperature of 300°C is disclosed on page 19, line 13, to page 20, line 9, of the present specification. Other enabling embodiments with die-bonding at a temperature of 230°C are disclosed on page 23, lines 2-8, of the present

specification. Plainly, the disclosure is enabled for embodiments reciting die-bonding in the temperature range of 100°C to 250°C as also supported by original claim 1. Claim 30 of the present application recites that the die-bonding feature occurs "under conditions of 100-250°C temperature," and this feature of Claim 30 has been claimed since Preliminary Amendment (A), filed on February 20, 2001, and throughout the present prosecution.

Second, the Examiner appears to contend that the die-bonding temperature range of 100-230°C may be enabled, whereas the presently recited temperature range of 100-250°C would not be enabled (Office Action, dated July 2, 2004, page 4, lines 4-11). The difference between these two temperature ranges is the 20 degree range spanning 230-250°C.

Enablement is a question of law, determined upon the weighing of many factors. In re Wands, 8 U.S.P.Q.2d 1400, 1404 (Fed. Cir. 1988). Factors to consider when determining whether a disclosure would require undue experimentation include (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims. Id.

Applicants previously provided an analysis of the Wands factors in Amendment (D), filed April 14, 2004, page 20, line 11, to page 30, line 6, and incorporates these arguments herein by reference. Applicants point out that the present specification as originally filed provides a detailed example of the invention die-bonded at 230°C (See original specification, page 22, line 10, to page 23, line 8) and a detailed example die-bonded at 300°C (See original specification, page 19, line 13, to page 20, line 11). Applicants contend that these two examples are sufficient to enable the broader claimed temperature range of die-bonding at "100-250°C" because Applicants' disclosure provides considerable direction and guidance on

how to practice the invention, there are multiple working examples spanning the higher temperature range, there is a high level of skill in the art, the methods and materials needed to practice the invention are well known, and the breadth of the broader temperature range is only slightly broader than the narrower range. While the degree of predictability in practicing the invention is not known, it reasonably is less than in the biotechnological arts, which have been deemed enabled under similar circumstances. In re Wands, 8 U.S.P.Q.2d at 1406. Consequently, Applicants believe that, upon considering the totality of the Wands factors, as a matter of law Applicants have enabled the broader claimed range, which can be practiced by a person of ordinary skill in the art without undue experimentation.

Third, while Applicants previously argued preferred embodiments reciting the narrower temperature range of 100-230°C (See Amendment (C), filed June 30, 2003, page 9, lines 8-20, and page 19, lines 8-16), Applicant also separately argued a different preferred embodiment reciting the broader temperature range of 100-250°C (See Amendment (C), filed June 30, 2003, page 9, line 21, to page 10, line 8, and page 19, lines 17-23). In fact, Applicants clearly stressed the unexpected superiority of this embodiment of the invention over prior art films at the die-bonding temperature of 250°C. Applicants contend that separately arguing the merits of various preferred embodiments does not necessarily render other embodiments, whether claimed or unclaimed, as lacking enablement. As discussed above, the proper test of enablement is whether a person of ordinary skill in the art can make and use the invention without undue experimentation. Amgen Inc. v. Hoechst Marion Roussel, Inc., 65 U.S.P.Q.2d at 1400.

In the present case, Applicants previously asserted that the claims were unnecessarily narrowed with respect to the die-bonding temperature (Amendment (D), filed April 14, 2004, page 11, lines 6-10). Applicants have made no statement, either expressed or implied, that

would lend a person of ordinary skill in the art to conclude the present disclosure lacks enablement for die bonding temperature conditions between 230°C and 250°C. On the contrary, the working examples provided in the specification, as well as Applicants' repeated arguments pertaining to unexpected and superior results at a die-bonding temperature of 250°C clearly refute any such inference.

Fourth, the Examiner has mistakenly applied In re Mayhew, 188 U.S.P.Q. 356 (C.C.P.A. 1976), which stands for the proposition that an applicant cannot claim more than his disclosure enables. The issue in the present case is different. In this case, the issue is whether the Applicant can claim as much as the disclosure enables. As stated by the Applicants in Amendment (D), filed April 14, 2004, page 11, lines 7-9, the claims were unnecessarily narrowed in Amendment (C).

Presently, the Examiner appears to be confusing "enablement" with disclaimed subject matter. See Athletic Alternatives Inc. v. Prince Manufacturing Inc., 37 U.S.P.Q.2d 1366, 1373 (Fed. Cir. 1996); Vectra Fitness Inc. v. TNWK Corp., 49 U.S.P.Q.2d 1144, 1146 (Fed. Cir. 1998). However, the broader temperature range has never been unequivocally disclaimed by the Applicants for two reasons. First, claim 30 is an original claim added by Preliminary Amendment (A) that recites the broader 100°C to 250°C die-bonding temperature range and that has been pending throughout the present prosecution. Second, it was previously argued that the superior and unexpected results, provided by films of the present invention over Morita's prior art films, are observed at 250°C (See Amendment (C), filed June 30, 2003, page 19, lines 17-23). Therefore, it is evident that the Applicant never intended to disclaim the higher die-bonding temperature range.

Alleged Lack of Enablement Due to "Repugnant" Terms

The Examiner contends that the recitation of "a peel strength of 0.5 kgf/(5 mm x 5 mm chip)" is "repugnant to the art" (Office Action, dated October 14, 2003, page 4, lines 9-15; Office Action, dated July 2, 2004, page 4, lines 17-20), thereby rendering claims 17, 30-34, 37-57 and 64 as failing to comply with 35 U.S.C. § 112 by lacking enablement. The Examiner's position is untenable and must be withdrawn for the plain and simple reason that it was known in the art, before the invention was made, to report the peel strength of a die-bonding material in units of "Kgf/mm^2." To establish this fact, Applicants filed an Information Disclosure Statement on November 2, 2004 that included a copy of Japanese Publication Kokai Document No. 06-136300 (hereafter, the Takashi'300 Document), published May 17, 1994. The Takashi'300 Document relates to a conductive paste composition, which is a die-bonding material, and reports peel strength in units of Kgf/mm^2 in Table 2. From this fact, it is established that reporting peel strength of a die-bonding material in units of mass-force per area is known to persons of ordinary skill in the art and is not "repugnant."

Rejections under 35 U.S.C. § 112, second paragraph

Applicants assert claims 17-19, 21-34 and 39-64 are in compliance with 35 U.S.C. § 112, second paragraph.

The courts have held that for a claim to comply with 35 U.S.C. § 112, second paragraph, it must (1) set forth what the applicant regards as his invention, and (2) it must do so with sufficient particularity and distinctness to be definite. Solomon v. Kimberly-Clark Corp., 55 U.S.P.Q.2d 1279, 1282 (Fed. Cir. 2000). The definiteness of the claim language must be analyzed in light of the teachings of the prior art and of applicant's disclosure as it

would be interpreted by one possessing ordinary skill in the pertinent art. Id. When applicant has claimed what he regards as his invention, a rejection under 35 U.S.C. § 112, second paragraph, must be justified on the grounds that the language used is not precise and definite enough to indicate the scope of the claim, or the language is so broad that it causes the claim to have a scope of protection beyond that which is justified by the applicant's disclosure. In re Swinehart, 169 U.S.P.Q. 226, 229 (CCPA 1971). Lastly, when reviewing claim language, it is the person of ordinary skill in the art whose eyes the claims are construed. Multiform Desiccants Inc. v. Medzam Ltd., 45 U.S.P.Q.2d 1429, 1432 (Fed. Cir. 1998).

The Examiner asserts that one issue is that the limitation of "a peel strength of 0.5 kgf/(5 mm x 5 mm chip)," as recited in claims 17, 30, 51 and 64 is "incorrect," thereby rendering the claims indefinite (Office Action, dated July 2, 2004, page 5, lines 9-13). Applicants respectfully disagree. As the Takashi'300 Document proves, it is correct in the field of die-bonding material manufacturing to report peel strength in units of Kgf/mm^2, which is a measurement in units of mass-force to area. Therefore, the claims are not rendered indefinite for reciting peel strength in units of mass-force to area as the Examiner contends. Instead, a person of ordinary skill in the art, who is presumed to have knowledge of any special meaning and usage of the Kgf/mm^2 units, Multiform Desiccants Inc. v. Medzam Ltd., 45 U.S.P.Q.2d at 1432, would understand their clear meaning in the field.

Regarding claims 17, 23-34, 37-44, 47-57 and 64, Applicants assert that these claims are in compliance with 35 U.S.C. § 112, second paragraph, for the following additional reasons.

1. Claim language is definite

Specifically, claim 17 of the present invention recites

> "[a]n organic die bonding film having a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2, wherein said film comprises an organic material selected from the group consisting of epoxy resin, silicone resin, acrylic resin and polyimide resin."

In the present case, the invention is an organic die bonding film "having a peel strength" as specifically defined in the present specification (page 33, lines 1-16), and the bond is further described by the language "when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2."

The Examiner contends that the claim language of claim 17 is indefinite because peel strength is a property of the bond, and not a property of the adhesive film (Office Action, dated July 2, 2004, page 5, line 14, to page 6, line 2). Applicants respectfully disagree with the Examiner's claim interpretation for multiple reasons.

First, the phrase "an organic die bonding film having a peel strength..." would be reasonably interpreted by a person of ordinary skill in the art as reciting "an organic die bonding film exhibiting a peel strength...when a semiconductor has been bonded to a support member with said film" because the word "having" encompasses "exhibiting" or "showing" within its meaning (See Webster's new collegiate dictionary," 1977, page 526, attached herewith). In other words, the word "having" encompasses "exhibiting" or "showing," where what is exhibited or shown is the "peel strength...when a semiconductor has been bonded to a support member with said film," which reasonably refers to the adhesive bond of plural materials and not to the die bonding film alone as if it existed in a vacuum.

Second, the test of definiteness, under 35 U.S.C. § 112, second paragraph, must be analyzed in light of the teachings of the prior art and of applicant's disclosure as it would be interpreted by one possessing ordinary skill in the pertinent art. Solomon v. Kimberly-Clark

Corp., 55 U.S.P.Q.2d at 1282. In the present case, a person of ordinary skill in the art would recognize within claim 17 plural materials, being the combination of (i) an organic die bonding film, (ii) a semiconductor, and (iii) a support member, bonded together with the bond described by peel strength. Thus, the language of claim 17 reasonably recites the characteristic of an adhesive bond of plural materials.

Claim 51 of the present invention recites

> "[a]n organic die bonding film bonding with a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2, wherein said film comprises an organic material selected from the group consisting of epoxy resin and polyimide resin."

In this case, the language particularly points out and distinctly claims "an organic die bonding film bonding with a peel strength...when a semiconductor has been bonded to a support member with said film...." A person of ordinary skill in the art would immediately recognize that the peel strength recited in claim 51 is a characteristic of the adhesive bond of plural materials, which include (i) the organic die bonding film, (ii) the semiconductor, and (iii) the support material, where it is the organic die bonding film that is the bonding material. For these reasons, Applicants assert that a person of ordinary skill in the art would understand the scope of claim 51.

2. Applicants' claim language is not "repugnant to the art"

Courts have held that there is no requirement for the claims of a new invention to speak in the language of the prior art so long as any new expressions in the claims are definite. In re Fisher, 166 U.S.P.Q. 18, 23 (C.C.P.A. 1970). As the law permits, an applicant may act as his own lexicographer and ascribe a certain meaning to a claim term when the applicant's

written description supports that meaning. Digital Biometrics Inc. v. Identix Inc., 47 U.S.P.Q.2d 1418, 1424 (Fed. Cir. 1998).

As the law permits, the present inventors have acted as their own lexicographer by ascribing a certain meaning to the claim term "peel strength" as supported by the written description of the originally filed application. Specifically, "peel strength" in accordance with the present invention means "peel strength" as fully described and defined by Figure 2 and page 33, lines 1-16, of the present application.

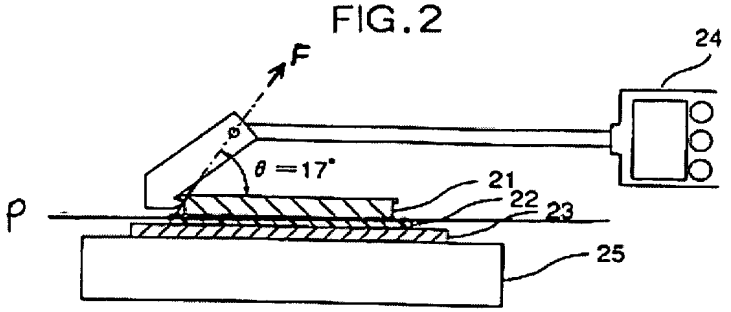
Mr. Masuko, one of the co-inventors, stated in his Declaration under 37 C.F.R. § 1.132, dated April 8, 2004, (of record)(hereafter, the "Second Masuko Declaration"), that the peel strength test described in the present application was developed specifically for this application for the purpose of providing a more efficient test for testing the detrimental effects of reflow cracking (Second Masuko Declaration, page 9, line 21 to page 10, line 16). Specifically, Mr. Masuko stated that the peel strength test disclosed in the present application was developed to apply a test force diagonally at an angle of 17-degrees to the plane of the adhesive film in order to simultaneously evaluate both linear areal peel strength and shear peel strength adhesive properties of the organic die-boning films of the present invention (Second Masuko Declaration, page 9, lines 9-20). Mr. Masuko stated that, in his opinion, a person of ordinary skill in the art would realize that the peel strength test defined in the present application is a 17-degree peel strength test (Second Masuko Declaration, page 8, lines 5-10). Mr. Masuko stated that he knew of no conversion factor that could be used to convert peel strength values obtained using the 17-degree peel strength test, described in the present application, to 90-degree peel strength values obtained using a 90-degree peel strength test because he did not believe there was a linear relationship between linear and shear adhesive peel strength properties (Second Masuko Declaration, page 9, lines 13-20).

In addition, Mr. Katogi, a researcher at Hitachi Chemical Company, Ltd. but not one of the co-inventors of the present application, stated in his Declaration under 37 C.F.R. § 1.132, dated April 9, 2004, (of record)(hereafter, the "Katogi Declaration"), that he recognized from the disclosure of the present application the description of a "17-degree peel strength" test (Katogi Declaration, page 6, line 14, to page 8, line 6). Mr. Katogi states that 90-degree peel strength tests apply a test force at an angle of 90° to the plane of the adhesive and that 180-degree peel strength tests apply a test force at an angle of 180° to the plane containing the adhesive (Katogi Declaration, page 7, lines 10-22). In Mr. Katogi's opinion, the "peel strength" test disclosed in Figure 2, and on page 33, lines 1-16, of the present application would be recognized by those skilled in the art as a 17-degree peel strength test in accordance with the custom of the industry (Katogi Declaration, page 6, line 14, to page 8, line 6).

The Examiner contends that the Second Masuko Declaration and the Katogi Declaration are opinions unsupported by facts (Office Action, dated July 2, 2004, page 26, lines 1-7). Applicants disagree and highlight the facts for the Examiner.

First, Mr. Masuko pointed out the fact that Figure 2, and page 33, lines 1-16, of the originally filed application, provided the description of Applicants' 17-degree peel strength test (Second Masuko Declaration, filed October 14, 2003, page 8, lines 3-9). Figure 2 of the present application is reproduced below, modified to show the plane P of the film (22) and the force F exerted by the push-pull gauge (24).

FIG.2



Mr. Masuko also discussed a conventional 90-degree peel strength test described in Figure 1 of International Standard ISO 8510-1 (of record) and a conventional 180-degree peel strength test described in Figure 2 of ASTM Standards, Designation: D 903-98 (of record), (Second Masuko Declaration, page 8, line 13, to page 9, line 11). Figure 1 of International Standard ISO 8510-1 and Figure 2 of ASTM Standards, Designation: D 903-98 are reproduced below for comparison to Figure 2 of the present application.

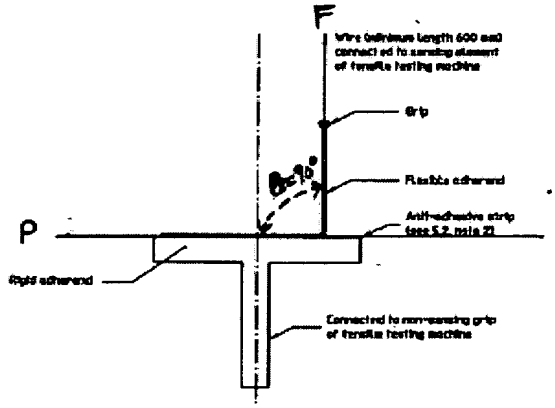


Figure 1 — Schematic diagram of 90° peel test for a flexible-bonded-to-rigid assembly

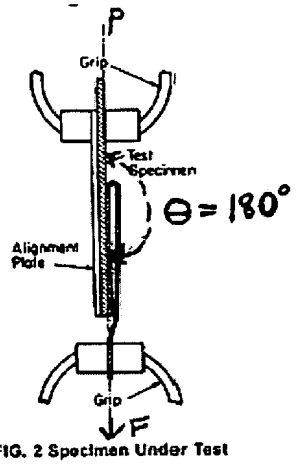


FIG. 2 Specimen Under Test

These three figures have been modified, for the purpose of comparison, to include character "F" indicating the line of force applied during the test, character "P" to indicate the plane of the adhesive bond, and θ to indicate the angle between F and P. Applicants assert specific evidence of record, the International Standard ISO 8510-1 and ASTM Standards, Designation: D 903-98, was analyzed by Mr. Masuko in the Second Masuko Declaration, page 8, line 13 to page 9, line 6, and by Mr. Katogi in the Katogi Declaration, page 7, line 3 to page 8, line 3, wherein these industry standards respectively describe conventional 90-degree and 180-degree peel strength tests using illustrations as is conventional in the art. Likewise, Applicants' disclosure describes its peel strength test with an illustration (i.e., Figure 2), and a person of ordinary skill in the art would immediately recognize from Figure 2 of the present application that the angle $\theta = 17°$ defines the angle between the line of force F applied by the push-pull gauge (24) and the plane P of the adhesive bond (See also Second Masuko Declaration, page 8, line 3, to page 11, line 7; and the Katogi Declaration, page 6, line 19, to page 8, line 18, and page 9, lines 7-18). Applicants' additionally assert that the written description on page 33, lines 7-16, of the present application, when taken together with what is shown in Figure 2 of the application, provides sufficient description to define

Applicants' 17-degree peel strength test in view of the industry convention of describing peel strength tests with illustrations.

However, this is not the only evidence of record. Mr. Katogi, a person of ordinary skill in the art, considered the 90-degree peel strength test described in International Standard ISO 8510-1, the 180-degree peel strength test described in ASTM Standards, Designation: D 903-98, and the peel strength test shown in Figure 2 and described on page 33, lines 7-16, of the present application. In Mr. Katogi's opinion, figures are conventionally used to define peel strength tests as supported by International Standard ISO 8510-1 and ASTM Standards, Designation: D 903-98. From these facts, Mr. Katogi concluded that Figure 2 of the present application, taken together with the written description on page 33, lines 7-16, of the application, would, in accordance with industry custom, reasonably describe a 17-degree peel strength test (Katogi Declaration, page 8, lines 4-16, and page 9, lines 7-18).

Therefore, the testimony of Mr. Katogi, who is a person of ordinary skill in the art of developing adhesives for semiconductor devices, establishes that the claimed "peel strength" would have a definite meaning when analyzed in the light of the teachings of the prior art and the Applicants' disclosure as it would be interpreted by a person possessing ordinary skill in the art. Consequently, as a matter of law, the term "peel strength" as it is used in independent claims 17, 30, 51 and 64 is definite in compliance with 35 U.S.C. § 112, second paragraph.

The Prior Art Rejections

Anticipation under 35 U.S.C. § 102 requires showing the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick, 221 U.S.P.Q. 481, 485 (Fed. Cir. 1984). On the other hand, a patentability analysis under 35 U.S.C. § 103

requires (a) determining the scope and content of the prior art, (b) ascertaining the differences between the prior art and the claimed subject matter, (c) resolving the level of ordinary skill in the pertinent art, and (d) considering secondary considerations that may serve as indicia of nonobviousness or obviousness. Graham v. John Deere Co. of Kansas City, 148 U.S.P.Q. 459, 467 (1966). Furthermore, a proper rejection under Section 103 further requires showing (1) that the prior art would have suggested to a person of ordinary skill in the art that they should make the claimed device or carry out the claimed process, (2) that the prior art would have revealed to a person of ordinary skill in the art that in so making or doing, there would have been a reasonable expectation of success, and (3) both the suggestion and the reasonable expectation of success must be found in the prior art and not in the applicants' disclosure. In re Vaeck, 20 U.S.P.Q.2d 1438, 1442 (Fed. Cir. 1991).

Rejections under 35 U.S.C. § 102

The Morita reference discloses an "insulating adhesive tape," that includes a base supporting film and an adhesive layer formed on at least one surface thereof (see Abstract). As shown in Figure 4, the adhesive tape includes base supporting film (41) and two adhesive layers (42) and (43). Each adhesive layer (42), (43) is a thermoplastic polymer comprising a thermoplastic polyimide, wherein the polymer has a glass transition temperature ranging from 180°C to 280°C and an elastic modulus ranging from 10^{10} dyne/cm^2 to 10^{11} dyne/cm^2 at 25°C, wherein the elastic modulus includes a value ranging from 10^2 dyne/cm^2 to 10^9 dyne/cm^2 at a temperature between 250°C and 300°C. The Morita reference discloses that the thermoplastic polymer has a water absorbing ratio of less than 1.2% (col. 9, lines 14-16); however, Morita does not explicitly state to what the percentage relates. Specifically, the Morita reference only describes % by weight (col. 9, lines 35-39 and lines 53-55); therefore,

it is suggested that Morita describes that the water absorbing ratio is less than 1.2% by weight. There is nothing in the Morita et al. reference to teach, or even suggest, that the water absorption is 1.5% by volume or less.

No Single Layer Structure

The Morita reference clearly discloses a three layer tape (4). The Morita reference does not teach, or even suggest, an "organic die-bonding single layer film" having the features recited in claims 19 and 58. The Examiner asserts that Morita teaches a "single layer structure" (Office Action, dated July 2, 2004, page 8, line 4 and line 9). Applicants contend that Morita's three layer tape (4) cannot be fairly interpreted to be a "single layer film" in accordance with claims 19 and 58 of the present application.

The Morita reference even explicitly states a "typical layer structure of the insulating tape...is shown in Fig. 3," wherein the tape (4) includes adhesive layers (42) and (43) separated by insulating film (41), (col. 7, lines 15-35). In addition, the test results provided in the Table at columns 17-22 of Morita are attributed to this three layered structure (col. 7, lines 26-35, and col. 17, line 13 to col. 18, line 30), and not to just layer (42) as the Examiner suggests, (See Office Action, dated July 2, 2004, page 7, line 15, to page 9, line 7).

When an examiner asserts there is either an explicit or implicit teaching in the prior art, the courts require the examiner to indicate where in the reference this explicit or implicit teaching appears. In re Rijckaert, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993). Furthermore, the Examiner is required to give a fair reading of what each prior art reference teaches as a whole. In re Gordon, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984).

In the present case, the Examiner has not met his burden with respect to giving a fair reading of what the Morita reference teaches because the Morita reference reasonably teaches

a multi-layered tape structure and not a "single layer film." Specifically, the Examiner has not met his burden of indicating where in the Morita reference there is a teaching, explicit or otherwise, that the "tape" (4) would be a "single layered film" or that it is solely the layer (42) of tape (4) that is responsible for the peel strength, elasticity, water absorption, and saturation moisture absorption properties of the tape (4). Thus, the 102 rejection against claims 19 and 58 must be reconsidered and withdrawn.

Bonding Conditions: temperature and pressure combination

The combinations of temperature and pressure that provide the bonding conditions recited in independent claims 17, 19, 30, 51, 58 and 64 of the present invention are neither disclosed nor obvious in view of Morita.

The Morita reference discloses that the adhesive temperature for bonding IC chips to lead frames using the adhesive tape is selected from the range of 250-450°C (preferably 270-400°C) and the adhesive pressure is 1-50 kg/cm^2 (preferably 5-30 kg/cm^2), (col. 14, lines 3-14). However, the present invention has the advantage that die bonding can be carried out, in general, at significantly lower temperatures and pressures than the prior art. The present claims recite "conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" in independent claims 17, 19, 30, 51, 58 and 64. As the Morita et al. reference does not teach, or even suggest, a bonding temperature of less than 250°C, Morita et al. can not anticipate the recited temperature range 100-250°C in combination with a pressure of 0.1-30 gf/mm^2 for the purposes of adhesive bond formation.

Furthermore, the Morita reference teaches that it is the tape (4), and not solely the layer (42), that is attributed with the properties listed in Morita's Table. In the July 2nd Office Action, the Examiner contends that layer (42) is solely responsible for the properties of tape

(4), (Office Action, dated July 2, 2004, page 7, line 15, to page 9, line 7). The Examiner has no factual basis for making such an assertion. In particular, the peel strength reported in Morita's Table is a property of the multi-layered tape (4), and not solely a property of the layer (42), (See col. 17, lines 13-28, and col. 18, lines 29-30).

Peel Strength

The Morita reference does not disclose "a peel strength of 0.5 Kgf/5mm x 5mm chip or higher, " as defined in the present specification and as recited in independent claims 17, 30, 51 and 64, when die-bonding "under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2".

The Examiner has previously stated that "Morita does not appear to literally teach that the film has a peel strength of 0.5 Kgf/5mm x 5mm chip or higher" (Office Action, dated October 14, 2003, page 13, lines 13-15; Office Action, dated July 2, 2004, page 15, lines 5-7). The Examiner asserts that, in the absence of unexpected results, it would be a matter of "design choice...ascertainable by routine experimentation and optimization" to arrive at the claimed peel strength range (Office Action, dated October 14, 2003, page 13, line 21 to page 14, line 6; Office Action, dated July 2, 2004, page 15, lines 7-19).

The Examiner's conclusion is untenable for the following reasons. First, the Examiner's argument is presently based on the layer (42) of tape (4) and not on tape (4), (See Office Action, dated July 2, 2004, page 7, line 15, to page 9, line 7). However, the peel strength reported by the Morita reference is for the tape (4), and is not solely attributable to the layer (42), (See col. 17, lines 13-28). Therefore, the peel strength values reported by the Morita reference cannot be reasonably applied as a characteristic of layer (42) alone, as the Examiner has done.

Second, Morita teaches measuring 90-degree peel strength (col. 18, lines 3-10). The peel strength recited in the claims 17, 30, 51 and 64 is a "peel strength" as specifically defined in the present specification, a 17-degree peel strength. As established by the Masuko Declaration, section 10, and by the Katogi Declaration, section 6, 90-degree peel strength is a test of linear areal adhesive strength that is not directly comparable to peel strength as defined in the present specification, which is a test of the combined properties of adhesive linear areal strength and adhesive shear strength. In other words, Morita only teaches values for adhesive linear areal peel strength and is completely silent with respect to the adhesive shear strength properties of its films. On the other hand, claims 17, 30, 51 and 64 of the present application recite peel strengths that are specifically defined in the present specification, and which reflect the combined adhesive effect of shear strength and linear areal strength properties of the films.

Morita cannot anticipate, or even suggest, the presently claimed "peel strength" values because the 90-degree peel strength test taught by Morita, by definition, cannot reflect adhesive shear strength. Therefore, Morita cannot be used to reasonably infer anything about the claimed peel strength properties of the present invention because Morita teaches nothing about adhesive shear strength. In other words, it is not possible to optimize the 90-degree peel strength properties of Morita's films to arrive at the peel strength properties (as clearly defined by the present specification) of the organic die-bonding films recited in independent claims 17, 30, 51 and 64.

Lastly, Applicants have previously shown by experimental evidence presented in the Second Masuko Declaration, filed October 14, 2004, that a film made in accordance with the Morita reference did not have the binding properties recited in independent claims 17, 19 and 51. Specifically, Applicants have shown that a prior art film made in accordance with

"Example 1" of the Morita reference did not exhibit "a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" (See page 3, lines 1-21, and Table 1 on page 5 of the Second Masuko Declaration). Presently, Applicants submit additional experimental evidence in the Third Masuko Declaration, filed herewith, to show that a prior art film, made in accordance with Embodiment No. 13 of the Table in Morita, also does not exhibit "a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" (See page 2, line 13, to page 3, line 10, and Table 1 on page 5 of the Third Masuko Declaration).

In view of the experimental evidence submitted in the Second Masuko Declaration and in the Third Masuko Declaration, Applicants have conclusively shown that the "peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2," as recited in claims 17, 30, 51 and 64, is not a characteristic of the films taught by the Morita reference.

Examiner's Contention that Reciting Peel Strength is an Intended Use

The Examiner contends that the limitation, recited in claim 17, of "having a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" is a "statement of intended use...which does not result in a structural difference between the claimed product and the product of Morita" (Office Action, dated July 2, 2004, page 13, lines 8-13). Applicants respectfully disagree for the following reason.

First, the present claims are composition claims. Inventions that are compositions may be defined by the composition and various properties obtained by the composition described by functional language. In re Swinehart, 169 U.S.P.Q. 226, 228-229 (C.C.P.A. 1971). Second, the peel strength exhibited by an organic die bonding film, in accordance with the present invention, is described in terms of the bond achieved by the film "when a semiconductor has been bonded to a support member with said film" as recited in the instant claims.

As addressed previously, the claims must be construed through the eyes of a person of ordinary skill in the art. Multiform Desiccants Inc. v. Medzam Ltd., 45 U.S.P.Q.2d at 1432. Furthermore, claim language that is more than a statement of purpose, and is essential to particularly point out the invention defined by the claims, carries patentable weight. In re Stencel, 4 U.S.P.Q.2d 1071, 1073 (Fed. Cir. 1987). In the present case, the contested claim language particularly points out and distinctly claims certain film compositions, in accordance with the present invention, that are described in terms of peel strength properties exhibited by the film when bonding a semiconductor to a support member. Such functional language is permissible and carries patentable weight. In re Swinehart, 169 U.S.P.Q. at 228-229.

Applicants assert that a person of ordinary skill in the art would recognize the claim language reciting peel strength as pertaining to a characteristic (i.e., a peel strength) exhibited by the film when bonding a semiconductor to a support member, which defines essential subject matter pertaining to certain embodiments of the present invention. In particular, Applicants contend the phrase "having a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher when a semiconductor has been bonded to a support member with said film under

conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2," recited in claims 17, 30, 51 and 64, is much more than an alleged statement of use and carries patentable weight.

In support of this contention, Applicants direct the Examiner to the Katogi Declaration, wherein Shigeki Katogi, a person of ordinary skill in the art, states he would recognize the 17-degree peel strength test described by the present application and that peel strength is a characteristic recited as a feature of the claims (See, Katogi Declaration, filed April 14, 2004, page 3, lines 14-20; page 5, lines 7-12; and page 8, lines 4-22).

In view of the above arguments and evidence, Applicants assert that the phrase "having a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" of claims 17, 30, 51 and 64 is a feature of the claimed invention carrying patentable weight, and is not a statement of intended use having no merit.

Void Volume

Independent claims 30 and 64 recite "a void volume of 10% or less in terms of voids present in the film...." The Examiner asserts that the Morita reference teaches a void volume of 0% (Office Action, dated July 2, 2004, page 11, lines 7-10). Applicants disagree with the Examiner's interpretation of the Morita reference and further assert that the Examiner has not given a fair reading to what Morita teaches as a whole.

Specifically, Morita states:

> "it is desirable that the amount of the solvent contained within the thermoplastic polymer layer formed over the base film is not more than 1% and that the imide reaction of the thermoplastic polyimide has been substantially completed. This can prevent the solvent volitization or the volitization of moisture produced due to an imidization chemical reaction during the short time thermo-melting-bonding at high temperature (generally, over 270°C) from contaminating the surface of the lead frame..., or producing void in the adhesive layer. (col. 8, lines 24-35)(emphasis added).

In this passage, the Morita reference reasonably teaches that when (i) the amount of solvent contained in the thermoplastic layer is not more than 1% and (ii) the imide reaction has been substantially completed, and (iii) thermo-melting-bonding at over 270°C is performed, then solvent volitization can be prevented from producing void in the adhesive layer.

The Examiner's contention that Morita anticipates "a void volume of 10% or less in terms of voids present in the film..." recited in the present claims is erroneous for multiple reasons. First, Morita teaches that whatever affect the amount of solvent contained in the thermoplastic layer, and the degree of completion of the moisture-producing imide reaction, has on void production is observed at bonding temperatures of over 270°C. However, the present claims are limited to bonding "under conditions of 100-250°C." Therefore, the teaching of Morita in col. 8, lines 24-35, is not relevant because it pertains to bonding at higher temperatures.

Second, while solvent volitization can produce void in the adhesive layer, there are other factors that can produce the void as well. For instance, moisture in the adhesive layer can also produce void. While Morita teaches reducing moisture produced in the adhesive layer by waiting for the moisture-producing imide reaction to be substantially complete before bonding (col. 8, lines 24-33), the Morita reference is completely silent with respect to moisture in the adhesive layer from other sources. The Morita reference is also completely silent with respect to other sources of void formation. Therefore, *arguendo*, even if the Morita reference could be reasonably construed to teach that the production of void due to solvent volitization, and due to moisture produced by an imidization reaction, can be completely prevented, the Morita reference neither teaches, nor even suggests, that all factors contributing to void formation are "prevented" and that the void volume would then be 0%.

On the contrary, the Morita reference is completely silent with respect to teaching any absolute number of voids. Therefore, while the Morita reference may teach a way of reducing voids in an adhesive layer, it does not reasonably teach "a void volume of 10% or less" as recited in claim 30 and 64 of the present application.

Lastly, Applicants assert that the Examiner is unreasonably stretching the meaning of the word "prevent" as used in the Morita reference. The word "prevent" is a term of degree and while it can mean "to keep from happening or existing," it can also mean to "hinder" or to "interpose an obstacle" (See Webster's new collegiate dictionary, page 912). There is nothing in the Morita reference that would reasonably lead a person skilled in the art to conclude that Morita was teaching an adhesive layer having 0% voids over teaching a way to hinder void formation. On the contrary, a person of ordinary skill in the art would recognize that the Morita reference taught reducing the number of voids by reducing the amount of volatile solvent in the adhesive, and by reducing moisture in the adhesive created by the imidization reaction. However, a person skilled in the art would realize that the Morita reference does not teach, or even suggest, minimizing moisture in the adhesive from sources other than the imidization reaction; therefore, the Morita reference would not teach the elimination of voids because the reference does not teach the elimination of moisture in the adhesive due to other moisture sources.

For all of the above reasons, the Morita reference does not teach, or even suggest, a "void volume of 10% or less in terms of voids present in the film..." when bonded "under conditions of 100-250°C" as required by claims 30 and 64.

Rejections under 35 U.S.C. § 103

The Examiner also relies upon the Morita reference as the basis for rejecting claims 17-19, 21-34, 37, 38 and 45-50 under Section 103. Applicants traverse this Section 103 rejection for the following reasons.

Result Effective Variables

The Examiner argues that the following are "result-effective variables:" (a) water absorption (October 14th Office Action, page 11, lines 6-8; July 2nd Office Action, page 9, line 16, to page 10, line 8), (b) void volume (October 14th Office Action, page 13, lines 3-5; July 2nd Office Action, page 11, lines 11-19), and (c) bonding temperature (October 14th Office Action, page 14, lines 7-17). While Applicants agree that bonding temperature is a result effective variable, Applicants disagree that water absorption and void volume are result effective variables. The Examiner's conclusion that water absorption and void volume are result effective variables is an error, as a matter of law, for the following reasons.

A result effective variable is a variable that effects the result of a process as demonstrated in In re Aller, 105 U.S.P.Q. 233, 234-235 (C.C.P.A. 1955). In Aller, 105 U.S.P.Q. at 234, the invention was a process for producing carbolic acid that varied from the prior art by using lower reaction temperatures and higher sulphuric acid conditions. In Aller, 105 U.S.P.Q. at 234, the court noted the fact that varying the temperature (i.e., a variable in the reaction process) had an effect on the production of phenol, carbolic acid (i.e., the result), and the issue decided by the court included whether a change in reaction temperature would have been obvious to one skilled in the art. The court in Aller, 105 U.S.P.Q. at 235, ruled that variation in temperature of a reaction process would be an unpatentable modification over the prior art in the absence of a new and unexpected result. It is notable that the court

considered reaction temperature to be a result effective variable while the yield of phenol was addressed as the result. In re Aller, 105 U.S.P.Q. at 235.

By analogy to Aller, the reaction process utilized in the present invention is a die bonding reaction process, which includes temperature as a result effective variable. Varying the temperature of the die bonding process will effect the result, which is the state of the organic die bonding material that forms a die bond. The state of the organic die bonding material is described in terms of the properties of the die bonding material (i.e., water absorption, void volume, etc.). In other words, while the die bonding temperature is a result effective variable, the water absorption and void volume properties of the die bonding material are the results. Consequently, as a matter of law, the Examiner is incorrect when he concludes that it would be obvious to optimize water absorption and void volume properties of the organic die bonding film recited in claims 30 and 64 because water absorption and void volume are not variables that effect a result (i.e., result effective variables) but are results effected by variables.

Another way to understand the Examiner's error is to look at the presently claimed invention and the pertinent inventions of the caselaw cited by the Examiner (October 14th Office Action, page 12, lines 4-8; July 2nd Office Action, page 10, lines 11-18). The presently claimed invention is directed to an organic die bonding film, such as recited in claims 30 and 64, which is an article of manufacture or a composition of matter. The organic die bonding film of the presently claimed invention is not a method or a process. Compare Aller, 105 U.S.P.Q. at 234, where the invention was a process for producing carbolic acid, or In re Kulling, 14 U.S.P.Q.2d 1056, 1056 (Fed. Cir. 1990), directed to a claimed process for the treatment of a dilute iron (II) sulfate-containing sulfuric acid solution. Concisely stated, it

is an error, as a matter of law, to apply rules directed to result effective variables to properties of a material.

Lastly, Applicants note the Examiner cited In re Hoeschele, 160 U.S.P.Q. 809 (C.C.P.A. 1969), which is directed to the unpatentability of certain polyurethane elastomers, and Merck & Co. Inc. v. Biocraft Laboratories Inc., 10 U.S.P.Q.2d 1843 (Fed. Cir. 1989), which is directed to the obviousness of a diuretic composition containing two known diuretics, amiloride hydrochoride and hydrochlorothiazide. Neither of these cases fairly stand for the proposition that properties of a material are result effective variables. In fact, the Examiner has not stated what propositions these cases stand for or how these two cases are even relevant to the present prosecution.

In summary, the Examiner has erroneously applied a rule directed to result effective variables pertaining to method claims to a claimed article of manufacture or composition of matter. As a matter of law, the Examiner's conclusion that the "void volume of 10% or less" and the "water absorption of 1.5% by volume or less," which are properties of the organic die bonding film recited in claims 30 and 64, would be obvious is untenable and must be withdrawn.

Combinations of the Prior Art

The courts have held that to reject claimed subject matter in view of a combination of prior art references, a proper analysis under 35 U.S.C. § 103 must show that (a) the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, (b) the prior art reveals that in so making, one of ordinary skill would have a reasonable expectation of success, and (c) both the suggestion and the reasonable

expectation of success is found in the prior art and not in applicant's disclosure. In re Vaeck, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991).

The Morita Reference

U.S. Patent 5,406,124 to Morita et al. (hereafter, the Morita Reference) teaches an insulating adhesive tape as described above, but does not teach, or suggest, (i) the combination of temperature and pressure bonding conditions recited in claims 17, 19, 30, 51, 58 and 64; (ii) "having a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" as recited in claims 17, 30, 51 and 64; a "void volume of 10% or less" as recited in claims 30 and 64; (iv) "an organic die-bonding single layer film" having the claimed features as recited in claims 19 and 58; and (v) a "saturation moisture absorption of 1% by volume or less" as recited in claims 18, 26 and 30 of the present application.

The Berger Reference

U.S. Patent 4,681,928 to Berger (hereafter, the Berger reference) discloses a "poly(amide-amide acid), polyamide acid, poly(esteramide acid), poly(amide-imide), polyimide, poly(esterimide) from poly arylene diamine." More particularly, Berger teaches reacting aromatic or aliphatic dianhydrides and/or acid anhydrides with certain aromatic diamines alone or in combination with other diamines to produce various compounds to include poly(amide-amide acid), polyamide acid, poly(esteramide acid), poly(amide-imide), polyimide, poly(esterimide), (See Abstract). Berger provides a long list of dianhydrides, such as 1,2-ethylene-bis-(trimellitate)anhydride, (col. 4, lines 10-58) that can be reacted with

various diamines, which includes 4,4'-diaminodiphenyl ether (col. 11, line 27 to col. 12, line 2), and suggests that various compounds could be synthesized by picking and choosing one of the dianhydrides and one of the diamines (col. 13, lines 55-68).

The Berger reference is completely silent with respect to adhesive bond formation under "conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" as recited in claims 17, 19 and 30, and the claimed characteristics of peel strength recited in claims 17 and 30, and claimed saturation moisture absorption recited in claims 18, 26 and 28-30.

The Jackson Reference

U.S. Patent 4,965,331 to Jackson (hereafter, the Jackson reference) discloses "curable resin compositions" that comprise a (bis- or poly-)-maleimide and a propargyl ether (See Abstract). Jackson teaches making maleimides by reacting maleic anhydride with a diamine, such as bis(4-amino-3,5-dimethylphenyl) methane (col. 2, lines 41-60). The Jackson reference does not teach that bis(4-amino-3,5-dimethylphenyl) methane is suitable for reacting with a dianhydride such as 1, 2-(ethylene)bis(trimellitate anhydride). Therefore, the Examiner has not shown there is a suggestion grounded in the prior art, and not Applicants' disclosure, to justify combining the diamine, bis(4-amino-3,5-dimethylphenyl) methane, with the teachings of the Morita and Berger references.

Furthermore, the Jackson reference is completely silent with respect to adhesive bond formation under "conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" as recited in claims 17, 19 and 30, and the claimed characteristics of peel strength recited in claims 17 and 30, and claimed saturation moisture absorption recited in claims 18, 26 and 28-30.

The Baumann Reference

U.S. Patent 5,296,567 to Baumann et al. (hereafter, the Baumann reference) discloses "thermocurable compositions" based on at least one cationically polymerisable organic material and an initiator for cationic polymerisation in the form of an onium compound or a compound of the formula $[M^{+n}(L)_x]^{n+}nX^{--}$ (col. 1, lines 4-30). Baumann teaches making these compounds with diamine side groups such as bis(4-amino-3,5-diisopropylphenylphenyl) methane (col. 5, lines 1-9). The Baumann reference does not teach that bis(4-amino-3,5-diisopropylphenylphenyl) methane is suitable for reacting with a dianhydride such as 1, 2-(ethylene)bis(trimellitate anhydride). Therefore, the Examiner has not shown there is a suggestion grounded in the prior art, and not Applicants' disclosure, to justify combining the diamine, bis(4-amino-3,5-diisopropylphenylphenyl) methane, with the teachings of the Morita and Berger references.

Furthermore, the Baumann reference is completely silent with respect to adhesive bond formation under "conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" as recited in claims 17, 19 and 30, and the claimed characteristics of peel strength recited in claims 17 and 30, and claimed saturation moisture absorption recited in claims 18, 26 and 28-30.

The Yoshida Reference

U.S. Patent 5,115,089 to Yoshida (hereafter, the Yoshida Reference) teaches "processes for preparation of polyimide-isoindroquinazolinedione and precursor thereof" for making polymers useful as heat-resistant electric insulation materials (See Abstract). In particular, the process taught by the Yoshida reference prepares a precursor of polyimide-isoindroquinazolinedione by reacting together (i) a tetracarboxylic acid dianhydride having

the general formula (I) shown in col. 2, lines 32-48, (ii) a diaminoamide compound having the general formula (II) shown in col. 2, lines 49-65, and (iii) another diamine (col. 2, lines 28-66).

The Examiner contends that the Yoshida reference teaches reacting a diamine with 1, 10 (decamethylene)bis(trimellitate anhydride), (abbreviated "DBTA") to make a polyimide (July 2nd Office Action, page 19, lines 14-16). This is not a fair reading of what the Yoshida reference teaches.

The Yoshida reference teaches the synthesis of polyimide-isoindroquinazoline precursors by reacting together three compounds (i.e., a tetracarboxylic acid dianhydride, a diaminoamide compound, and another diamine), not two compounds. These three compounds are always reacted together to make the polyimide (col. 6, lines 17-25). In fact, the Yoshida reference explicitly teaches that the diaminoamide compound and the diamines are dissolved together, then the dianhydride is added and the reaction takes place (col. 6, lines 617-25). In Example 4, for example, the diaminoamide compound 4,4'-diamiodiphenylether and the diamine 4,4'-diamino diphenyl ether-3-carboxylic acid amide are dissolved together, and then DBTA is added and the reaction takes place (col. 9, lines 44-60, and col. 10, lines 55-60).

Thus, the Yoshida reference teaches reacting DBTA with both a diaminoamide compound and a diamine simultaneously to make a polyimide precursor. The Yoshida reference does not reasonably teach, or even suggest, reacting just DBTA with a diamine to make a polyimide.

Applicants assert that any combination of the teachings of the Yoshida reference with the teachings of the Morita reference would lack a proper suggestion to combine and would fail to suggest a reasonable expectation of success. In particular, the Yoshida reference

would not reasonably suggest to a person of ordinary skill in the art to react DBTA with a diamine and without a diaminoamide compound. Furthermore, if both DBTA and a diaminoamide compound were added to the synthesis taught be Morita, it would be unascertainable to a person of ordinary skill in the art as to whether a polyimide having the desired properties of the claimed invention would result. Therefore, any combination of the teachings of the Morita reference and the Yoshida reference would either (i) fail to properly suggest the combination for making a polyimide, and/or (ii) fail to provide a reasonable expectation of success that in so making the resulting polyimide, which would be synthesized from the diaminoamide compound, would have the same properties as those of the presently claimed invention.

Furthermore, the Yoshida reference is completely silent with respect to adhesive bond formation under "conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" as recited in claims 17, 19 and 30, and the claimed characteristics of peel strength recited in claims 17 and 30, and claimed saturation moisture absorption recited in claims 18, 26 and 28-30.

In summary, any combination of the Morita reference, the Berger reference, the Jackson reference, the Baumann reference, and the Yoshida reference would not teach, or even suggest, an "organic die-bonding film" having the "a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" as recited in claims 17, 30, 51 and 64. Furthermore, any combination of the Morita reference, the Berger reference, the Jackson reference, the Baumann reference, and the Yoshida reference would

not teach, or even suggest, an "organic die-bonding single layer film" having the features recited in claim 19.

Saturation Moisture Absorption

The Examiner's rejection of claims 18, 26 and 30 is untenable and should be withdrawn because each of these claims recites a "saturation moisture absorption of 1% by volume or less," and the Examiner has failed to establish a prima facie case of obviousness. Specifically, the Examiner states that "Morita does not appear to explicitly disclose...the film having a saturation moisture absorption of 1% by volume or less" (July 2nd Office Action, page 19, lines 15-16).

The Examiner then asserts that the Japanese Document JP 05-218107 (hereafter the Hozoji reference) teaches this limitation (July 2nd Office Action, page 19, lines 17-20). However, the Examiner's conclusion is flawed because the Hozoji reference teaches saturation moisture absorption for the semiconductor device as a whole, and does not teach the saturation moisture absorption for a die-bonding film.

Specifically, the Hozoji reference teaches, in paragraph [0009], an adhesive film made from 30 g of epoxy denatured polybutadiene, 20 g of blom-containing styrenic resin, 50 g of fluorine-containing bismaleimide resin, 0.8 g of benzoguanamine and 0.5 g of 2,5-dimethyl-2,5-di(t-butyl peroxyl)hexyne-3 dissolved in solvent, wherein the film is formed by heating the mixture at 130-150°C to remove the solvent. Then the adhesive film is used to fix a semiconductor device to a die pad at 130°C, followed by curing at 220°C for 120 minutes as taught by the Hozoji reference in paragraph [0009]. Subsequently, a resin encapsulated semiconductor device is prepared, as taught by paragraph [0009] of the Hozoji reference, by subjecting the bonded semiconductor-die pad assembly to transfer molding using an

encapsulate agent of epoxy resin. Lastly, the Hozoji reference teaches, in paragraph [0009], that by subjecting the encapsulated semiconductor device to 85% humidity at a temperature of 85°C, followed by heating at 265°C for 90 seconds, the result is a semiconductor device having the saturation moisture absorption values listed in Table 1 of the Hozoji reference.

In summary, the Hozoji reference teaches saturation moisture absorption values in Table 1 for resin encapsulated semiconductor devices and this reference does not reasonably teach, or even suggest, teaching saturation moisture absorption values for the adhesive film used to fix a semiconductor device component to the die pad. In addition, because the adhesive film is encapsulated by an outer layer of epoxy resin when the encapsulated semiconductor is subjected to the moisture absorption process, a person of ordinary skill in the art would recognize that the moisture absorption process taught by Hozoji is unlikely to affect the saturation moisture absorption value of the encapsulated adhesive film.

The Examiner also argues that the hypothetical construct provided by the combination of the Morita reference and the Hozoji reference would "inherently" have the properties recited in the claims of the present application (July 2nd Office Action, page 18, lines 12-17). The Examiner's contention is flawed because, like the Morita reference, the Hozoji reference fails to teach, or even suggest, "having a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" as recited in claims 17, 30, 51 and 64, and a "void volume of 10% or less" as recited in claims 30 and 64 of the present application.

The Examiner's contention that the hypothetical construct combining the teachings of the Morita reference and the Hozoji reference would "inherently" teach the claimed invention is also untenable and should be withdrawn because inherency applies to rejections under 35

U.S.C. § 102. Continental Can Co. USA Inc. v. Monsanto Co., 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991). However, the present rejection is a Section 103 rejection and inherency cannot be properly applied.

Finally, Applicants point out that "inherency" may not be established by mere possibility or probability, but must flow naturally from the disclosure of the single prior art reference. Id. In this case, the closest prior art reference is the Morita reference, and Applicants' data submitted in the Second Masuko Declaration and the Third Masuko Declaration clearly show, as discussed below, that the films taught by Morita do not have "a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher when a semiconductor has been bonded to a support member with said film under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" as recited in claims 17, 30, 51 and 64. The Hozoji reference does not make up this deficiency, so there is no reason the hypothetical construct combining the teachings of the Morita reference and the Hozoji reference would "inherently" have the claimed peel strength under the requisite bonding conditions required by the claims.

For all of the above reasons, any rejection standing against claims 18, 26 and 30, whether under Section 102 or Section 103, is untenable and must be withdrawn because the Examiner has not reasonably established that the claimed limitation directed to saturation moisture absorption of a die bonding film is taught by any of the prior art references.

Residual Volatile Component

The Examiner's rejection of claims 21, 22, 25 and 30 is untenable and should be withdrawn because each of these claims recites a "residual volatile component in an amount of not more than 3.0 % by weight," and the Examiner has made no argument that this limitation is taught by any of the prior art references. The present specification defines

"residual volatile component" on page 27, line 22 to page 28, line 2, and this feature is not limited to the amount of residual solvent. Morita teaches that, after drying, the amount of solvent contained within the thermoplastic polymer layer is not more than 15% by weight (col. 9, lines 53-59). However, the "residual volatile component" of films recited in claims 21, 22, 25 and 30 is not limited to solvent residues.

Applicants believe that a person skilled in the art, reading the definition of residual volatile component defined on page 27, line 22 to page 28, line 2, of the present specification, would realize that all volatile substances removed by heating are reflected in the present definition of residual volatile component. In other words, the solvents used would make up only a portion of the volatile component. Other volatile substances, such as water, would be included in the residual volatile component defined in the present specification. The property addressed by Morita is solely related to the amount of solvent retained by the thermoplastic polymer layer and does not consider other substances that make up the "residual volatile component" as defined in the present specification.

For all of the above reasons, any rejection standing against claims 21, 22, 25 and 30, whether under Section 102 or Section 103, is untenable and must be withdrawn because the Examiner has ignored the claimed limitation directed to residual volatile component and none of the prior art references reasonably address this feature of the claims.

Unexpected and Superior Results of the Present Invention

Applicants previously submitted for the Examiner the Declaration by Takashi Masuko (hereafter the "First Masuko Declaration"), dated March 5, 2002, filed in accordance with 37 C.F.R. 1.132. The Examiner stated many objections to the First Masuko Declaration to include (a) the declaration did not refer to the individual claims (October 14th Office Action,

page 18, lines 17-20), and (b) the comparative evidence did not compare the claimed invention to the closest prior art of Morita (October 14th Office Action, page 21, lines 8-2012).

The Comparative Evidence is Commensurate in Scope with the Claims

Courts have held that evidence of non-obviousness must be commensurate in scope with the claims. Burlington Industries v. Quigg, 3 U.S.P.Q.2d 1436, 1438 (Fed. Cir. 1987). The Examiner's opinion appears to be that for any Declaration to be commensurate in scope with the claims, that Declaration must discuss the claims or it will not be considered (October 14th Declaration, page 18, lines 17-20). Applicants believe that the Rules of Practice in Patent and Trademark Cases (37 C.F.R.) and the common law are the rules that properly apply to Applicants. There is no rule in 37 C.F.R. or in the common law that requires a declaration refer specifically to the claims.

Be that as it may, Applicants previously submitted a revised Declaration by Takashi Masuko (hereafter the "Second Masuko Declaration"), executed in April 2004, and filed on October 14, 2003 in accordance with 37 C.F.R. 1.132. The Second Masuko Declaration establishes that when the novel film (see Section 7 on page 4) made in accordance with the present invention is compared to the closest prior art film (see Section 6 on page 3) disclosed by the Morita Reference under identical experimental conditions, the result is that the novel film of the present invention demonstrates an "**unexpected superiority**" (Second Masuko Declaration, page 7, lines 13-23). As shown in Table 2 on page 6 of the Second Masuko Declaration, when evaluating the two films for the occurrence of reflow cracks it was shown that while **all** of the Morita film samples under the given die-bonding conditions manifested

reflow cracks, **none** of the samples made in accordance with the present invention had reflow cracks.

In addition, when peel strength was measured (Second Masuko Declaration, section 8), the peel strength as defined by Figure 2 and page 33, lines 1-16 of the present application was significantly greater for the novel film of the present invention over the Morita film (see Table 1 on page 5 of the Second Masuko Declaration). In fact, when the die-bonding condition was set as "250°C x 30gf/mm^2 x 20 sec," as in claims 17, 19, 30, 51, 58 and 64, all of the chips made using the novel film were destroyed during testing because the bond strength was stronger than the chip. In other words, the bond strength of the material in accordance with the present invention was stronger than what this particular test could measure! Clearly, this is another superior and unexpected result.

Example 1 of Morita is the Closest Prior Art

Courts have long held that an applicant relying on a comparative showing to establish secondary evidence of non-obviousness must compare the claimed invention to the closest prior art. In re Merchant, 197 USPQ 785, 788 (CCPA 1978). However, an indirect comparison between the claimed invention and the closest prior art may be acceptable in some circumstances. In re Fouche, 169 U.S.P.Q. 429, 433 (C.C.P.A. 1971).

In this case, Applicants have compared the claimed invention (See Section 7 of the Second Masuko Declaration) to Morita's prior art film described as Example 1 (See Section 6 of the Second Masuko Declaration). The Examiner argues that the prior art film of Example 1 of the Morita reference is not the closest prior art and previously asserted that Embodiment No. 13, compiled in Table 1 of Morita, is the closest prior art (October 14th Office Action, page 21, lines 8-12; July 2nd Office Action, page 27, line 17, to page 28, line 4). Applicants

disagree with the Examiner's conclusion; however, the issue is moot as Applicants submit herewith experimental evidence establishing the superior and unexpected results provided by a film made in accordance with the present invention over a film made in accordance with Embodiment No. 13 of the Morita reference.

Embodiment No. 13 of Morita

Applicants presently submit, attached herewith, a Declaration by Takashi Masuko (hereafter the "Third Masuko Declaration"), executed October 26, 2004, in accordance with 37 C.F.R. § 1.132. The Third Masuko Declaration establishes that when the novel film (see Section 7 on page 3) made in accordance with the present invention is compared to the prior art film (see Section 6 on page 3) corresponding to Embodiment No. 13 disclosed by the Morita Reference under identical experimental conditions, the result is that the novel film of the present invention demonstrates an "**unexpected superiority**" (Third Masuko Declaration, page 6, line 8, to page 7, line 11). As shown in Table 2 on page 6 of the Third Masuko Declaration, when evaluating the two films for the occurrence of reflow cracks it was shown that while **all** of the Morita film samples under the given die-bonding conditions manifested reflow cracks, **none** of the samples made in accordance with the present invention had reflow cracks.

In addition, when peel strength was measured (Third Masuko Declaration, section 8) the peel strength, as defined by Figure 2 and page 33, lines 1-16 of the present application, was significantly greater for the novel film of the present invention over the Morita film corresponding to Embodiment No. 13 (see Table 1 on page 5 of the Third Masuko Declaration). As previously mentioned, when the die-bonding condition was set as "250°C x 30gf/mm^2 x 20 sec," as in claims 17, 19, 30, 51, 58 and 64, all of the chips made using the

novel film were destroyed during testing because the bond strength was stronger than the chip. Clearly, this is a superior and unexpected result demonstrating the significant improvement of the die-bonding film, made in accordance with the present invention, over the die-bonding film corresponding to Embodiment No. 13 of the Morita reference.

Summary of Unexpected Results

The Second Masuko Declaration is commensurate in scope with independent claims 17, 19, 30, 51, 58 and 64 of the present application, and the Second Masuko Declaration specifically addresses this issue in Section 9. The Second Masuko Declaration compares the present invention, represented by the embodiment described in Section 7 of the Second Masuko Declaration, to the closest prior art of Morita, which is Example 1 (See Section 6 of the Second Masuko Declaration). Applicants assert that Example 1 of Morita represents the closest prior art because the bonding conditions compiled for Embodiments Nos. 1-6 in the Table of Morita are closer to those recited in claims 17, 19, 30, 51, 58 and 64 than the bonding conditions taught for Morita's Embodiment No. 13.

The Third Masuko Declaration is commensurate in scope with independent claims 17, 19, 30, 51, 58 and 64 of the present application, and the Third Masuko Declaration specifically addresses this issue in Section 9. The Third Masuko Declaration compares the present invention, represented by the embodiment described in Section 7 of the Third Masuko Declaration, to the prior art film of Embodiment No. 13 of Morita (See Section 6 of the Third Masuko Declaration).

As the evidence of non-obviousness submitted in the Second Masuko Declaration and the Third Masuko Declaration establish, the organic die bonding film made in accordance with the presently claimed invention exhibits substantially improved and unexpectedly

superior peel strength (as defined by the present specification) and the absence of reflow cracks when compared to organic die bonding prior art films of Morita.

For all of the reasons argued above, Applicants assert that the comparative testing submitted in the Second Masuko Declaration and in the Third Masuko Declaration is sufficient to overcome any prima facie obviousness rejection in view of the Morita reference. See In re Soni, 34 U.S.P.Q.2d 1684, 1688 (Fed. Cir. 1995).

Examiner's Objections to the Second Masuko Declaration

The Examiner has objected to the Second Masuko declaration as (i) being directed to a system and not to claims 51-64, (ii) the evidence of non-obviousness does not cover the entire claimed range, (iii) the Declaration is directed to a process and not to the claimed product, (iv) the evidence of non-obviousness is not compared to the closest prior art, which the Examiner now asserts should be an identical polyimide, and (v) the alleged unexpected results are not unexpected because Morita teaches, at col. 7, lines 65-68, the results submitted in the Second Masuko Declaration (July 2nd Office Action, page 27, line 1, to page 28, line 10).

Experimental Evidence is Commensurate in Scope with Claims 51-64

Claims 51-64 have a scope similar to claims 17, 19, 30 and 39-44. Claims 17, 19, 30 and 39-44 are commensurate in scope with the evidence of non-obviousness provided in the Second Masuko Declaration and the Third Masuko Declaration for the reasons of record. In actuality, claims 51-64 recite die-bonding films of narrower scope than those recited in claims 17, 19, 30 and 39-44 because claims 51-64 are limited to "an organic material that includes epoxy resin and polyimide resin." The novel film, made in accordance with the

present invention, compared against prior art films of Morita included epoxy resin and polyimide resin (See Second Masuko Declaration, page 4, lines 1-8; and Third Masuko Declaration, page 3, lines 11-18). Therefore, the evidence of non-obviousness submitted in the Second Masuko Declaration and the Third Masuko Declaration are commensurate in scope with the subject matter of claims 51-64 for the same reasons it is commensurate in scope with the subject matter of claims 17, 19, 30 and 39-44.

Evidence of Non-obviousness Sufficiently Represents the Claimed Range

The unobviousness of a broader claimed range can be proven by a narrower range of data when one of ordinary skill in the art can ascertain a trend exemplified in the data that extends the probative value of the data. In re Kollman, 201 U.S.P.Q. 193, 199 (C.C.P.A. 1979). In the present case, the independent claims 17, 19, 30, 51, 58 and 64 all recite die-bonding of the film "under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2." The evidence of non-obviousness submitted in the Second Masuko Declaration and the Third Masuko Declaration are compiled in Table I of each of these documents. This evidence provides three tested data points, which covers a narrower range of temperatures and pressures than the claimed ranges.

The evidence of non-obviousness submitted in the Second Masuko Declaration and the Third Masuko Declaration establishes that as die-bonding temperature and pressure are decreased, the peel strength of die-bonding films decrease; however, the die-bonding film made in accordance with the present invention maintained the property of a "a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher" under the tested conditions (See Table 1 in each of the Second Masuko Declaration and the Third Masuko Declaration). On the other hand, neither of the films made in accordance with Example 1 and Embodiment No. 13 of the

Morita reference were able to achieve the claimed peel strength. Whether the film tested was the novel film made in accordance with the present invention, or a prior art film taught by Morita, the data submitted in Table 1 of each of the Second Masuko Declaration and the Third Masuko Declaration show a decrease in peel strength as temperature and pressure conditions are decreased. Applicants contend that a person of ordinary skill in the art would recognize a trend in the data wherein lower bonding temperatures and pressures result in lower peel strength of the bonding adhesive. Furthermore, Applicants contend that the data shows that only the films made in accordance with the present invention were able to attain the peel strength values recited in the instant claims when bonded under temperature and pressure conditions falling within the scope of the claims.

Applicants also contend that a person skilled in the art would realize that the adhesive films taught by Morita, especially those of the Table shown in the Morita reference, effectively die-bond at temperatures between 270-380°C. Since the effective temperature bonding conditions for films made in accordance with the present invention is significantly lower than the effective die-bonding range shown by the Morita reference, and because the films made in accordance with the Morita reference also demonstrate the same tendency to form weaker bonds at lower die-bonding temperature and pressures, a person skilled in the art would reasonably conclude that the narrow range of pressure and temperature conditions tested would predict poor binding properties for the Morita films when die-bonded at even lower temperatures and pressures than those tested.

In summary, the data presented in Table 1 of the Second Masuko Declaration and in Table 1 of the Third Masuko Declaration establish the trend that while peel strength of an adhesive die-bonding film decreases at lower die-bonding temperatures and pressures, die-binding films made in accordance with the present invention are able to exhibit peel strength

in excess of 0.5 kgf/(5 mm x 5 mm chip) whereas die-bonding films made in accordance with the Morita reference are not able to bond effectively. Therefore, the probative value of the presently submitted data can be reasonably extended to show that die-bonding films made in accordance with the present invention will substantially outperform, at even lower die-bonding temperatures and pressures, the die-bonding films taught by Morita.

The Evidence of Unexpected Results Pertains to a Die-bonding Film, not a Process

The Second Masuko Declaration, on page 4, line 16, to page 17, line 10, and the Third Masuko Declaration, on page 4, lines 3-17, explicitly describe that it is properties of the prior art and novel films, which are cut into 5 x 5 mm sized pieces, that are compared to one another. In Tables 1 of the Second Masuko Declaration and the Third Masuko Declaration the property of peel strength is compared, and in Tables 2 of each of these Declarations the property of occurrence of reflow cracks is compared. It is plainly evident that the properties (i.e., peel strength and reflow cracking) of films are compared.

The Claimed Invention is Compared to the Closest Prior Art

An applicant relying on a comparative showing to establish secondary evidence of non-obviousness must compare the claimed invention to the closest prior art. In re Merchant, 197 USPQ 785, 788 (CCPA 1978). However, the applicant is not required to compare the invention to the invention, In re Chapman, 148 U.S.P.Q. 711, 714 (C.C.P.A. 1966), and there is no requirement that the applicant compare the invention to something that does not exist in the prior art, In re Geiger, 2 U.S.P.Q.2d 1276, 1279 (Fed. Cir. 1987)(Newman, J., concurring).

In the present case, Applicants contend that Example 1 of the Morita reference is the closest prior art, and evidence of non-obviousness of the present invention over this Morita film is presented in the Second Masuko Declaration. The Examiner has previously contended that Embodiment No. 13 of the Morita reference is the closest prior art (October 14th Office Action, page 21, lines 8-12). Evidence of non-obviousness of the present invention over this Morita film is presented in the Third Masuko Declaration. Therefore, any dispute over whether a film made in accordance with the presently claimed invention has been compared to the closest prior art is moot.

The Examiner makes an unclear statement asserting that "the closest prior art and the instant claims recite an identical polyimide...the closest prior art of Morita includes all of the structural and composition limitations of the claims" (July 2nd Office Action, page 28, lines 1-4). Applicants respectfully traverses the Examiner's broad and unsupported statement. The Examiner has shown no embodiment in the Morita reference that is closer to the claimed invention than the films of either Example 1 or Embodiment No. 13.

The Examiner's contention that Morita teaches a film identical to the presently claimed invention is without merit. The burden is on the Examiner to show where in a prior art reference all explicit or implicit teachings or suggestions are to be found in the prior art reference. In re Rijckaert, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993). Furthermore, the Examiner cannot require the Applicants to compare the invention to the invention to overcome a rejection under 35 U.S.C. § 103. In re Chapman, 148 U.S.P.Q. at 714.

The Morita Reference Does Not Teach the Results Submitted in the Declarations

The Examiner contends that the Morita reference teaches the results shown in the Second Masuko Declaration (July 2nd Office Action, page 28, lines 5-7). Applicants respectfully disagrees for the following reasons.

The Morita reference states, at col. 7, lines 65-68, the following:

> "However, the treatment effect in the thermoplastic polymer layer of the present invention is remarkable beyond expectations. The adhesive strength to the substrate can be improved and stabilized largely."

Nothing in this statement by Morita refers to the present invention or makes an explicit or implicit comparison to the presently claimed invention. Plainly, the statement made in the Morita reference in 1995 does not address the peel strength characteristics of a die-bonding film made in accordance with the present invention, which bonds at temperatures and pressures lower than those shown in Table 1 of the Morita reference. Furthermore, even if this statement in the Morita reference were to be taken (unreasonably) to address a film made in accordance with the present invention, the evidence submitted in the Second Masuko Declaration and in the Third Masuko Declaration establishes that the Examiner's interpretation of the above statement made by Morita is wrong. The films made in accordance with the Morita reference are not "remarkable beyond expectation" when compared to a film made in accordance with the present invention. On the contrary, the data provided in the Second Masuko Declaration and the Third Masuko Declaration show that a film made in accordance the presently claimed invention is "remarkable beyond expectation" over the Morita films when bonding "under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2."

Applicants incorporate herein the arguments made previously in Amendment (B) filed June 19, 2002, and in Supplemental Response to Amendment (B) filed October 16, 2002, and in Amendment (C), filed June 30, 2003, and in Amendment (D) filed April 14, 2004.

Conclusion

Claims 17-19, 21-34 and 37-64 are now in compliance with 35 U.S.C. 112. The rejection of claims 17, 19 and 30 under 35 U.S.C. § 102(b), or in the alternative under 35 U.S.C. §103(a), over the Morita reference is untenable and should be withdrawn because all of the claimed limitations are neither disclosed nor suggested by the reference. Specifically, Morita does not teach or suggest the following: (a) the bonding "conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2" recited in claims 17, 19 and 30; (b) "peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher" recited in claim 17 and 30, where the meaning of "peel strength" is defined by Figure 2 and page 33, lines 1-16 of the present application; (c) "saturation moisture absorption of 1.0% by volume or less" recited in claims 18, 26, and 28-30; or (d) an "organic die-bonding single layer film" having the features recited in claim 19. Claims 51-64 are separately patentable because they define a narrower organic material limitation not taught or suggested in the prior art.

Furthermore, for the reasons discussed above, none of the Berger reference, the Jackson reference, the Baumann Reference, the Yoshida reference and/or the Hozoji reference are combinable with the Morita reference to make up even a single one of these deficiencies.

For the reasons evinced above, Applicants do not agree that the Examiner has properly established a prima facie case of obviousness. However, even if it were assumed, *arguendo*, that a proper prima facie case of obviousness was standing against independent

claims 17, 19, 30, 51, 58 and 64, the evidence of non-obviousness submitted in the Second Masuko Declaration and in the Third Masuko Declaration are sufficient to rebutt and overcome the prima facie case. In particular, the factual results wherein the organic die-bonding film of the present invention manifests unexpected invulnerability to reflow cracking, and wherein the property of peel strength as defined by the present application is considered, any prima facie case of obviousness standing against claims 17, 30, 51 and 64 is fully rebutted. In these claims, the material includes the property of "a peel strength of 0.5 kgf/(5 mm x 5 mm chip) or higher," as defined by the present specification, which is not even attainable by the comparison prior art film materials, made in accordance with the teachings of the Morita reference, when die-bonding "under conditions of 100-250°C temperature and pressure of 0.1-30 gf/mm^2."

For all of the above reasons, claims 17-19, 21-34 and 39-64 are in condition for allowance, and prompt notice of allowance is earnestly solicited. Questions are welcomed by the below-signed attorney for applicants.

Respectfully submitted,

GRIFFIN & SZIPL, P.C.

Joerg-Uwe Szipl
Registration No. 31,799

GRIFFIN & SZIPL, P.C.
Suite PH-1
2300 Ninth Street, South
Arlington, VA 22204

Telephone: (703) 979-5700
Facsimile: (703) 979-7429
Customer No. 24203